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ENTOMOLOGICAL NEWS

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The Progression Factor in the Growth of the Japanese Beetle (Popillia japonica Newman) (Coleop.: Scarabaeidae).

By DANIEL LUDWIG, Department of Biology, University College, New York University.

Calvert (1929) gave an excellent review of the published work on the progression factor in the growth of Arthropods, considering in turn, the application of Brooks' Law, Dyar's law, and the principle of Przibram. In Crustacea, Brooks (1886) found that at each successive molt there is a definite increase in length. In *Coronis* larvae, he found that the length of the larva increases uniformly at each molt by one-fourth of its length before the molt. Dyar (1890) observed that in Lepidoptera, the width of the head of the larva in its successive stages follows a regular geometrical progression. Przibram and Megusar (1912) working on the Egyptian praying mantis, *Sphodromantis bioculata*, observed that with each molt the shed skin is double the weight of the preceding exuvia and the weight of the newly molted insect shows a doubling from molt to molt. They also found that the length of the prothorax increases from one molt to the next as the cube root of two, or 1.26, and that increases in area occurred at the rate of the square root of two, or 1.41+.

In the case of Przibram's principle, the definite progression in the growth of the insect is supposed to result from a single division of the body cells. The progression implies that each molt represents a definite increase in size which is correlated with a definite number of cell divisions. It postulates that between molts all cells have divided only once. Sztern (1914) advanced the hypothesis that there is a simultaneous division of all cells in the praying mantis, *Sphodromantis bioculata*, and Bodenheimer (1933) also states that a simultaneous division of all body cells may occur in insects. Huettner (1923) re-

ported that in *Drosophila melanogaster,* all cells are in the same stage of division during the early cleavage stages of the egg. He found (personal communication) that later, however, cell divisions are very irregular and remain so during embryonic and larval development. Hence, in *Drosophila* it is definitely known that cell divisions are not simultaneous except in the early cleavage stages.

The principle of Przibram was deduced from studies on insects with incomplete metamorphosis. Its application is demonstrated by the work of Przibram and Megusar (1912), Titschack (1924), Eidmann (1924), Bodenheimer (1927, 1932), Teissier (1928a), and others. That the doubling in weight from molt to molt is due to the division of all of the cells of the insect is suggested by the work of Sztern (1914) who counted the number of cells in the epidermis of the mantis, *Sphodromantis bioculata,* and concluded that they doubled in number from one molt to the next. He made observations on the meso-thoracic ganglion and reported that since there is very little variation in the size of the ganglion nuclei, and since all dimensions of the ganglion increase from molt to molt as the cube root of two, there is also a doubling of the number of ganglion cells from one molt to the next. He also found that the length of the facets of the compound eye increased from molt to molt as the cube root of two. Friza (1928) demonstrated a doubling of the number of cells in the epidermis, and a doubling of the mass of each cell composing each ommatidium of the compound eye of the walking stick, *Dixippus morosus,* from one molt to the next. Przibram (1930) showed that in the mantis, *Sphodromantis bioculata,* between stages I and VI, there is a doubling of the corneal volume at each molt, and between stages VI and IX, the length of each facet increases only very slightly, but that there is a doubling of the number of eye facets.

In the case of Brook's law, Dyar's law, and Przibram's principle, Calvert (1929) pointed out that there are considerable fluctuations in the rates of growth and that growth constants obtained by each method are very variable, due to individual

differences. He emphasized that Przibram and Megusar (1912) found a considerable range of variation in their weighings and measurements of the praying mantis. For the first nine molts, the average increase in weight of the exuviae from one molt to the next ranged from 1.54 to 2.54, mean 2.02; of the living insect from 1.40 to 3.36, mean 2.09. The average increase in length of the prothorax of the exuviae from one molt to the succeeding molt ranged from 1.18 to 1.36, mean 1.28; in the living insect from 1.13 to 1.38, mean 1.29. Individual measurements showed a greater range of variation in each series. To account for this variation, they state that in many cases instead of doubling its weight from molt to molt, the animal more than doubles and this is usually followed by a standstill in the following stage. Przibram and Brecher (1930) found that the average progression factor of the Japanese mantis, *Tenodera aridifolia*, for the different instars ranged from 1.753 to 2.643 with an average of 2.143. Titschack (1930) showed that in the bed bug, *Cimex lectularius*, the progression factors are not constant but decrease with the age of the animal. He gives the following factors for successive instars: 2.56, 2.06, 1.94, and 1.76. Calvert (1929) applied the principle of Przibram to his measurements on different species of Odonata. Because of the variations in the progression factors obtained, he stated, "the growth factor, calculated from existing data, often varied greatly from instar to instar. These data, in most cases, do not allow us to do more than assume very varying rates of growth". A typical example of the variations he obtained is given below. These figures are for successive instars of an individual dragon fly of the species, *Nannothemis bella*, and are taken from Table VII, page 258. They are as follows: 1.22, 1.27, 1.02, 1.28, 1.44, 1.11, 1.22, 1.21, 1.36, 1.36, 1.37, as compared with a constant of 1.26 required by Prizibram's principle. In spite of this variation, Bodenheimer (1933) in his discussion of Calvert's results, asserted that the agreement between Calvert's data and Przibram's principle is obvious. This statement is based on the fact that the average of all the progression factors which Calvert obtained on various species was

approximately 1.26. Hodge (1933) found that the progression factors of the grasshopper, *Melanoplus differentalis,* ranged from 1.08 to 1.64. He believes that the variations in the factors and the irregularity of occurrence of the variations, make the application of Przibram's principle rather doubtful. Similar variations have been found in a number of species of hemimetabolous insects as a study of the tables in the review of Bodenheimer (1932) will show.

With regard to holometabolous insects, the principle is not well established. In these insects, the weight is usually more than doubled between molts, and the hypothesis has been advanced that all of the body cells go through several divisions between each molt. This explanation has been offered by Alpatov (1929) and Bodenheimer (1927, 1932). Alpatov (1929) states, "The need for a double division and multiplication by 1.26 indicates that each of the moltings in *Drosophila* larvae is connected with two cell divisions. It is very likely that the limited number (two) of moltings during the larval life of Diptera cyclorrhapha is a process of secondary reduction, and that in an earlier phylogenetic stage the larvae were characterized by four moltings, each of them linked with one cell division." Titschack (1926) found that in the clothes moth, *Tineola biselliella,* molting is not dependent on body size and that under different experimental conditions, the number of molts varies from 4 to 40. He also demonstrated that, in the clothes moth, the increase in size becomes progressively less with succeeding molts. Teissier (1928b) found that *Tenebrio molitor* may, under certain conditions, lose weight progressively with each molt. No evidence is available, for holometabolous insects, which would show positively whether the increase in weight between molts can be correlated with a definite number of cell divisions.

Ludwig (1932) studied the growth of the Japanese beetle at the temperatures of 20° and 25° C. and attempted to apply Przibram's principle to his results. Because of the range and the variation in the constants obtained, he stated that the investigations on the Japanese beetle do not substantiate the prin-

ciple. With reference to this work, Bodenheimer (1933) writes, "For the Japanese beetle (*Popillia japonica*), Ludwig denies the value of Przibram's principle. But his data mainly confirm it, if we consider that *Popillia* as a holometabolic insect with many divisions cannot show a full agreement." Bodenheimer included a table showing the mean observed weights after each molt (taken from Ludwig's paper), the calculated values, and some of the percentage deviations of the calculated from the observed results. Two percentages (—27.7% and —29.8%), which do not show a very close agreement, he fails to include. The present study is an analysis of the results obtained on the growth of the Japanese beetle and an attempt to apply Przibram's principle, as modified for the growth of holometabolous insects by Bodenheimer (1932 and 1933).

Tables I and II list the weights at successive molts of each of the Japanese beetle larvae reared to the completion of the growth period at 25° and 20° respectively. These readings, in every case, were made within 24 hours after the molt. The calculated results were obtained by the method of Bodenheimer (1932). It consists of dividing the maximum weight for each insect by 2 and the resulting figure by 2, etc., as indicated in Table III. The figure corresponding more closely to the weight observed at the end of each molt is the calculated weight for that stage. The number of divisions by 2 which is necessary to change the figure from a calculated weight after a molt to that after the molt just preceding, indicates the number of cell divisions which, according to Bodenheimer, has occurred between the molts.

A study of these tables will show that the Japanese beetle is extremely variable in size and rate of growth. As pointed out by Ludwig (1932), at 25°, the ratio of the weight after the first molt to the weight of the newly hatched larva ranges from 4 (in number 123) to 12 (number 141) with an average of 6.5; at 20°, it ranged from 4 (number 181) to 8 (number 201) with an average of 5.7. At 25°, the ratio of the weight immediately following the second molt to the weight immediately following the first molt ranged from 3 to 8, with an average

Table I. Calculated and Observed Weights (expressed in milligrams) of Japanese Beetle Larvae reared at 25° C.

No.	Wt. when hatched obs.	Wt. when hatched calc.	% Deviation	Wt. of 2nd instar obs.	Wt. of 2nd instar calc.	% Deviation	Wt. of 3rd instar obs.	Wt. of 3rd instar calc.	% Deviation	Max. larval wt.	No. of divisions calc.
15	2.7	2.3	—17.3	17.6	18.4	+ 4.3	94.7	73.8	—28.3	295.2	7
16	2.6	2.1	—23.8	19.5	17.3	—13.3	94.0	69.5	—35.2	278.3	7
19	2.6	2.6		21.8	21.2	— 2.8	115.0	84.9	—35.4	339.7	7
20	2.2	2.4	+ 8.3	20.5	19.3	— 6.2	81.3	77.4	— 5.0	309.7	7
21	2.3	2.0	—15.0	17.6	16.4	— 7.3	87.3	65.9	—32.4	263.8	7
22	2.4	2.0	—20.0	15.7	16.7	+10.1	87.4	67.1	—30.2	268.5	7
23	2.5	2.6	+ 3.8	20.2	22.2	+ 9.0	114.9	88.8	—29.3	355.5	7
24	2.5	2.0	—25.0	20.7	16.1	—28.5	85.0	64.7	—31.3	258.8	7
25	2.5	2.4	— 4.1	17.9	19.3	+ 7.2	96.8	77.4	—25.0	309.6	7
27	2.2	1.5	—46.6	15.5	12.3	—26.0	69.1	49.5	—39.5	198.3	7
28	2.5	2.1	—19.0	11.3	17.4	+35.0	42.9	35.9	—19.5	143.8	6
29	2.0	1.8	—11.1	15.9	14.2	—11.9	73.9	57.1	—29.4	228.4	7
30	2.7	2.3	—17.3	19.8	18.5	— 7.0	100.2	74.2	—35.0	296.9	7
31	2.2	2.5	+12.0	13.0	10.0	—30.0	55.4	40.1	—38.1	160.6	6
32	2.4	2.3	— 4.3	17.5	18.6	+ 5.0	107.1	74.4	—43.9	297.8	7
34	2.3	2.2	— 4.5	15.0	17.6	+14.8	83.4	70.7	—17.9	283.0	7
35	2.5	2.1	—19.0	15.9	17.3	+ 8.7	83.8	69.6	—20.4	277.9	7
36	2.8	2.3	—21.7	17.5	18.7	+ 6.8	98.1	74.9	—30.9	299.7	7
37	2.1	3.0	+30.0	17.5	23.2	+24.5	94.5	83.0	—13.8	322.0	7
38	2.5	2.0	—25.0	20.3	16.5	—23.0	85.1	66.0	—28.9	264.6	7
39	2.8	2.5	—12.0	18.3	20.1	+ 9.9	103.8	80.7	—28.6	322.9	7
40	2.7	3.1	+12.9	15.7	12.2	—28.6	52.1	47.1	—10.6	188.7	6
42	2.2	1.9	—15.8	15.0	15.5	+ 3.2	80.4	62.3	—29.0	249.4	7
43	2.8	2.1	—33.3	16.5	17.3	+ 4.6	85.8	69.3	—23.8	277.2	7
44	2.6	2.0	—30.0	21.7	16.1	—34.7	87.0	64.6	—34.6	258.7	7
45	2.5	2.5		18.4	20.1	+ 9.2	104.8	80.7	—29.8	322.8	7
46	2.6	2.6		22.8	22.1	— 3.1	109.5	88.5	—23.7	334.0	7
47	2.3	2.0	—15.0	17.0	16.6	— 2.4	100.2	66.4	—50.9	265.8	7
48	2.2	2.1	— 4.7	17.1	17.2		90.7	69.1	—31.2	276.7	7
49	2.3	2.0	—15.0	18.5	16.2	—14.1	85.6	65.1	—31.4	260.5	7
51	2.3	2.1	— 9.5	19.4	16.8	—15.4	94.2	67.3	—39.9	269.4	7
52	1.9	1.4	—35.7	15.4	11.4	—35.0	69.9	45.9	—52.2	183.6	7
53	2.2	2.5	+12.0	19.8	20.4	+ 3.0	95.5	81.8	—16.7	327.3	7
54	2.1	2.1		17.4	17.4		100.0	69.8	—43.2	279.2	7
55	1.9	2.3	+17.3	16.2	18.7	+15.4	88.8	74.9	—18.5	299.6	7
56	2.2	1.6	—37.5	14.2	13.1	— 8.3	64.1	52.6	—21.8	210.5	7
58	2.5	2.3	— 8.7	16.5	18.6	+11.2	84.8	74.7	—13.5	299.1	7
59	1.9	2.1	+ 9.5	16.3	16.5	+ 1.2	81.5	66.3	—22.9	265.4	7
60	2.5	2.1	—19.0	16.5	16.9	+ 2.3	74.6	67.9	— 9.8	271.6	7
61	2.3	2.4	+ 4.1	16.7	19.2	+14.9	115.3	77.1	—49.5	308.6	7
62	2.3	2.4	+ 4.1	19.8	19.3	— 2.6	111.1	77.3	—43.7	309.4	7
63	2.0	2.6	+23.0	14.1	20.4	+44.7	88.0	81.7	— 7.7	326.9	7
64	2.3	1.7	—35.2	14.5	13.8	— 5.0	67.8	55.3	—22.6	221.4	7
65	1.9	1.3	—46.1	14.9	21.5	+30.6	97.8	86.1	—13.5	344.7	8
66	2.2	1.8	—22.2	12.6	14.5	+15.0	74.8	58.0	—28.9	232.1	7
67	2.5	2.2	—13.6	19.2	17.7	— 8.4	91.2	70.8	—28.8	283.5	7
68	2.3	2.3		14.4	18.8	+23.4	74.6	75.4	+1.0	301.8	7
69	2.9	2.1	—38.1	15.5	17.2	+ 9.8	91.0	68.9	—32.0	275.7	7
70	2.4	2.6	+ 7.6	18.0	20.8	+13.4	101.6	83.4	—21.8	333.7	7
72	2.1	1.8	—11.1	16.9	15.0	—12.6	77.2	60.0	—28.6	240.0	7
73	2.0	2.3	+13.0	15.8	18.7	+15.5	95.5	74.8	—27.6	299.2	7
76	2.4	1.9	—26.3	16.5	15.8	— 4.4	80.4	63.2	—27.2	252.8	7
77	1.9	2.1	+ 9.5	15.9	16.9	+ 5.8	88.3	67.6	—30.6	270.7	7

No.	Wt. when hatched obs.	Wt. when hatched calc.	% Deviation	Wt. of 2nd instar obs.	Wt. of 2nd instar calc.	% Deviation	Wt. of 3rd instar obs.	Wt. of 3rd instar calc.	% Deviation	Max. larval wt.	No. of divisions calc.
78	1.8	1.6	—12.5	12.0	12.8	+ 6.2	73.7	51.4	—43.3	205.8	7
79	2.3	1.8	—27.7	15.9	14.9	— 6.7	88.6	59.7	—48.4	239.0	7
80	2.7	2.2	—22.7	13.2	17.9	+26.2	80.0	71.9	—11.2	287.9	7
81	2.8	2.9	+ 3.4	18.5	23.2	+20.2	105.9	93.0	—13.8	372.0	7
82	2.0	2.1	+ 4.7	17.3	17.5	+ 1.1	90.6	70.2	—29.0	280.9	7
83	2.5	2.1	—19.0	20.3	17.0	—19.4	101.8	68.2	—49.2	273.0	7
84	2.9	2.7	— 7.4	20.6	22.1	+ 6.7	104.4	90.4	—15.4	361.8	7
85	2.2	2.3	+ 4.3	16.8	18.7	+10.1	88.3	75.0	—17.7	300.0	7
86	2.7	3.6	+25.0	16.9	14.7	—14.9	88.3	58.8	—50.1	235.2	6
88	2.7	3.6	+25.0	11.9	14.4	+17.3	65.7	57.8	—13.6	231.4	6
90	2.2	2.3	+ 4.3	17.9	18.5	+ 3.2	107.3	74.1	—44.8	296.7	7
91	2.6	1.8	—44.4	14.1	15.0	+ 6.0	71.7	60.2	—19.1	240.9	7
92	2.8	2.1	—33.3	19.8	17.2	—15.1	101.4	69.1	—46.7	276.5	7
93	2.3	1.9	—21.0	13.9	15.7	+11.6	67.7	63.1	— 7.2	252.6	7
94	2.5	2.2	—13.6	17.2	18.2	+ 5.4	97.8	72.8	—34.3	291.3	7
95	2.3	1.8	—27.7	17.5	14.6	—19.8	89.3	58.5	—52.6	214.3	7
96	2.6	1.8	—44.4	16.6	15.0	—10.6	80.3	60.2	—33.3	241.1	7
97	2.8	2.8		20.5	23.1	+11.2	106.3	92.5	—14.9	370.1	7
98	2.1	1.5	—40.0	12.8	12.4	— 3.2	49.4	49.9	+ 1.0	199.8	7
99	2.6	2.5	— 4.0	13.7	10.1	—35.6	55.5	40.6	—36.7	162.6	6
101	2.2	2.2		16.2	17.9	+ 9.4	91.0	71.8	—26.7	287.4	7
102	2.1	1.9	—10.5	16.0	15.4	— 3.9	88.3	61.9	—42.6	247.9	7
103	2.7	1.9	—42.1	15.2	15.4	+ 1.3	69.7	61.9	—12.6	247.6	7
104	2.3	1.9	—21.0	16.3	15.8	— 3.1	84.3	63.2	—33.3	253.0	7
105	1.8	2.3	+21.7	15.0	18.4	+18.4	74.1	73.9		295.6	7
106	2.3	1.7	—35.2	14.5	13.8	— 5.0	78.1	55.2	—41.4	220.8	7
108	2.3	3.1	+25.8	12.7	12.8		73.3	51.4	—42.6	205.9	6
109	2.1	2.3	+ 8.7	19.2	18.6	— 3.2	81.2	74.5	— 8.9	298.3	7
111	1.5	1.6	+ 6.2	13.4	12.9	— 3.8	69.2	51.8	—33.5	207.5	7
112	2.6	2.2	—18.1	15.6	18.1	+13.8	98.2	72.7	—35.0	290.8	7
113	2.4	1.7	—41.1	16.1	13.8	—16.6	84.3	55.5	—51.8	222.1	7
115	2.2	2.2		17.2	17.8	+ 3.3	87.8	71.3	—23.1	285.4	7
116	2.3	2.2	— 4.5	15.2	17.8	+14.6	87.6	71.3	—22.8	285.6	7
117	2.0	2.0		15.1	16.6	+ 9.0	84.0	66.5	—26.3	266.1	7
118	2.3	2.0	—15.0	14.0	16.4	+14.6	78.1	65.6	—19.0	262.4	7
120	1.9	1.5	—26.6	12.4	12.2	— 1.6	64.6	48.8	—32.3	195.2	7
121	2.4	2.0	—20.0	17.6	16.5	— 6.6	85.5	66.2	—29.1	265.0	7
122	2.8	3.5	+20.0	13.3	14.2	+ 6.3	71.9	57.0	—26.1	228.0	6
123	2.5	3.2	+21.8	10.2	12.9	+22.4	63.4	51.7	—22.6	206.9	6
124	2.4	2.2	— 9.0	22.0	18.3	—20.2	109.0	73.5	—48.3	294.0	7
125	2.0	2.1	+ 4.7	18.0	16.9	— 6.5	100.1	67.7	—47.8	270.9	7
127	2.4	1.9	—26.3	13.7	15.4	+11.0	70.8	61.7	—14.7	247.1	7
128	2.6	1.8	—44.4	15.1	14.4	— 4.8	78.9	57.6	—36.9	230.6	7
129	2.1	1.8	—16.6	14.5	14.6		83.3	58.5	—42.3	234.0	7
130	2.0	1.8	—11.1	14.8	14.9		75.9	59.6	—27.3	238.6	7
133	2.6	1.9	—36.8	19.6	15.6	—25.6	99.4	62.4	—27.2	249.8	7
134	2.4	2.6	+ 7.6	17.8	21.4	+12.1	120.5	85.7	—40.6	342.0	7
136	2.4	2.1	—14.2	13.6	17.5	+28.6	72.6	70.1	— 3.5	280.5	7
137	2.6	1.8	—44.4	15.6	14.9	— 4.6	75.9	59.9	—26.7	239.9	7
138	2.0	1.8	—11.1	13.4	15.0	+17.3		60.1		242.6	7
139	2.5	2.1	—19.0	17.7	17.3	— 2.3	86.2	69.5	—24.0	278.2	7
140	2.5	2.7	+ 7.4	15.4	21.9	+29.6	106.5	87.6	—21.5	350.5	7
141	1.2	1.1	— 9.0	14.7	18.6	+20.9	92.8	74.4	—24.7	297.8	8
142	2.0	1.5	—33.3	12.0	12.5	+ 4.0	69.7	50.3	—38.5	201.5	7
143	2.9	2.4	—20.8	18.8	19.7	+ 4.5	104.2	79.0	—31.8	316.2	7
144	2.9	2.4	—20.8	17.7	19.4	+ 8.7	85.5	77.8	— 9.8	311.4	7

Table II. Calculated and Observed Weights (expressed in milligrams) of Japanese Beetle Larvae reared at 20° C.

No.	Wt. when hatched obs.	Wt. when hatched calc.	% Deviation	Wt. of 2nd instar obs.	Wt. of 2nd instar calc.	% Deviation	Wt. of 3rd instar obs.	Wt. of 3rd instar calc.	% Deviation	Max. larval wt.	No. of divisions calc.
151	1.9	1.7	—11.7	11.3	13.9	+18.7	63.6	55.6	—14.3	222.7	7
152	2.3	1.7	—35.2	11.7	13.9	+15.8	79.7	54.9	—45.1	219.8	7
153	2.2	2.3	+ 4.3	12.3	18.9	+34.8	48.0	37.9	—26.6	151.7	6
154	2.0	2.0		12.4	16.1	+22.9	92.8	64.6	—43.6	258.7	7
160	1.9	1.7	—11.7	11.8	13.9	+15.1	60.2	55.7	— 8.0	222.8	7
163	1.7	1.4	—21.4	11.0	11.7	+ 5.1	59.7	47.0	—27.0	188.3	7
164	1.9	1.5	—26.6	11.5	12.1	+ 4.9	54.5	48.4	—12.6	193.6	7
166	2.0	1.6	—25.0	14.1	13.2	— 6.7	75.7	52.9	—43.1	211.8	7
168	2.8	2.6	— 7.6	16.1	21.5	+25.1	98.7	86.0	—13.1	344.1	7
172	2.6	3.3	+21.2	13.4	13.5		61.2	54.3	—12.7	217.2	6
175	2.8	3.2	+12.5	13.6	13.0	— 4.6	52.7	52.0	— 1.3	208.1	6
176	2.2	1.8	—22.2	12.0	14.7	+18.3	57.5	59.0	+ 2.5	236.6	7
178	2.6	2.2	—18.1	15.6	17.8	+12.3	73.5	71.5	— 2.7	286.3	7
179	2.2	2.2		12.5	17.8	+29.7	64.4	71.5	+ 9.7	286.4	7
181	1.9	2.2	+13.6	8.4	8.8	+ 4.5	37.4	35.2	— 6.2	140.8	6
182	1.7	1.3	—30.7	11.8	11.1	— 6.3	50.1	44.7	—12.0	178.9	7
183	2.4	3.3	+27.2	12.2	13.2	+ 7.5	59.7	52.9	—12.8	211.7	6
184	2.5	2.2	—13.6	12.5	17.9	+30.1	71.7	71.8		287.2	7
185	2.3	1.9	—21.0	12.1	15.2	+20.3	59.9	61.1	+ 1.9	244.4	7
187	2.2	2.8	+21.4	10.4	11.3	+ 7.8	39.5	45.5	+13.1	182.2	6
190	2.3	1.8	—27.7	12.9	14.5	+11.0	58.0	58.2		233.0	7
194	2.3	2.4	+ 4.1	11.1	9.6	—15.6	51.4	38.5	—33.5	154.1	6
200	2.1	2.3	+ 8.6	12.9	19.0	+32.1	73.9	76.1	+ 2.8	304.4	7
201	2.0	1.6	—25.0	16.2	13.5	—20.0	66.8	54.3	—23.0	217.5	7
203	2.3	1.7	—35.2	13.7	13.7		59.6	54.9	— 8.5	219.8	7
204	2.4	2.5	+ 4.0	15.0	20.3	+26.1	83.0	81.2	— 2.2	324.8	7
205	2.2	1.6	—37.5	11.9	13.4	+11.1	77.0	53.6	—43.6	214.7	7
206	2.1	2.0	— 5.0	14.2	16.4	+13.4	70.7	65.7	— 7.0	262.9	7
207	2.4	3.1	+22.5	14.1	12.5	—12.8	52.5	50.0	— 5.0	200.0	6
208	2.7	1.9	—42.1	14.5	15.9	+ 8.8	63.0	63.7	+ 1.1	255.1	7
209	2.3	3.0	+23.3	12.4	12.0	— 3.3	61.2	48.3	—26.7	193.3	6
210	2.8	1.9	—47.3	14.7	15.4	+ 4.5	61.3	61.7		246.9	7
212	2.4	1.7	—41.1	13.2	13.7	+ 3.6	80.9	58.9	—37.3	239.9	7
213	2.7	2.7		12.8	10.9	—17.4	50.6	43.8	—15.5	175.2	6
215	2.8	1.9	—47.3	14.8	15.0	+ 1.3	74.1	60.1	—23.2	240.7	7
216	2.7	1.8	—50.0	13.0	14.2	+ 8.4	67.9	56.8	—19.5	227.2	7
217	2.2	1.5	—46.6	12.0	12.2	+ 1.6	56.2	48.8	—15.1	195.5	7
218	2.2	2.0	—10.0	13.2	16.0	+17.5	73.2	64.1	—14.5	256.4	7
220	2.3	1.9	—21.0	14.9	15.3	+ 2.6	80.0	61.3	—30.5	245.2	7
221	1.9	1.9		12.9	15.4	+16.2	63.6	61.7	— 2.1	247.0	7
228	2.8	2.3	—21.7	18.3	18.7	+ 2.1	92.8	75.1	—23.5	300.7	7
230	2.1	1.5	—40.0	12.6	12.0	— 5.0	59.8	48.3	—23.8	193.3	7
234	2.5	2.2	—13.6	16.8	17.7	+ 5.0	78.6	70.8	—11.0	283.5	7
235	2.6	3.2	+18.7	13.1	13.0	— 0.7	56.3	52.2	— 7.8	209.0	6
236	2.2	2.0	—10.0	11.9	16.9	+29.5	58.3	67.1	+13.1	268.6	7
239	2.0	1.6	—25.0	9.9	13.1	+24.4	42.0	52.5	+18.0	210.3	7
242	2 3	3.0	+23.3	12.6	12.1	— 4.1	55.1	48.5	—13.6	194.0	6
247	2.0	1.5	—33.3	9.5	12.6	+24.6	47.0	50.5	+ 6.9	202.0	7
254	2.1	1.8	—16.6	12.7	14.6	+13.0	59.9	58.4	— 2.5	233.9	7
259	2.7	2 4	—12.5	14.6	19.6	+25.2	92.2	78.5	—17.4	314.1	7
260	2.3	2.2	— 4.5	12.5	9.1	—37.3	46.8	36.5	—28.2	146.2	6
265	1.9	1.6	—18.7	13.0	13.2	+ 1.5	57.5	52.9	— 8.6	211.6	7
266	2.6	2.7	— 3.7	11.5	11.0	— 4.5	58.0	44.0	—31.8	176.0	6
268	2.0	1.5	—33.3	12.2	12.4	+ 1.6	57.2	49.8	—14.8	199.4	7
270	1.9	1.5	—26.6	12.8	12.4	— 3.2	55.6	49.8	—11.6	199.6	7

of 5.2; at 20°, it ranged from 3 to 8 with an average of 4.6. At 25°, the observed and calculated values very rarely show a close agreement and deviations usually range from 10 to more than 50 per cent. These discrepancies are especially apparent when the weights immediately following the molt to the third instar are considered. With the exception of two larvae, numbers 68 and 98, the calculated values are always smaller than the observed values and deviations of from 30 to 50 per cent are quite common. According to Przibram's principle, this suggests that the molt occurs when a division of only a part of the body cells has occurred. The principle postulates that molting occurs when all of the cells have divided. At 20°, the agreement between the observed and calculated weights is somewhat better than at 25°, although wide discrepancies are also very common. In both cases individual variations are so great that one is not justified in using the average weights of a group in the calculation of the progression factors as has been done by Bodenheimer (1933).

The probable number of cell divisions occurring during the growth of each larva is given in the last column of Tables I and II. The usual number, as calculated by dividing the maximum larval weight by two, in successive steps, until a number corresponding to the weight of the newly hatched larva is obtained, is seven. (There are only three larval instars in the Japanese beetle.) This method, as it has been applied, allows for a considerable amount of variation in the maximum larval weights before a change in the number of cell divisions is noted. For example, the weights of larvae numbers 23 and 24, when newly hatched, were 2.5 milligrams each. When growth was completed, number 23 weighed 355.5 milligrams and number 24 weighed only 258.8 milligrams, a difference of nearly 100 milligrams. Nevertheless, the number of cell divisions obtained by the above method of calculation is seven for each individual. In the case of larva number 23, the calculated initial weight corresponds very closely to that observed, while in larva number 24, the calculated initial weight deviates from that observed by — 25 per cent . This is less than the — 27.7 per cent devia-

tion shown in the table of Ludwig's data given by Bodenheimer (1933, page 94). An inspection of Tables I and II will show other cases which are just as variable in maximum weights but with seven calculated cell divisions. Very wide variations must be present before the method will show any changes in the number of cell divisions, provided deviations between calculated and observed results of from 20 to 30 per cent are permitted. Table I shows, however, that the number of cell divisions may vary, according to this method of calculation, from six to eight.

Table III. Calculated and Observed weights of Japanese Beetle Larvae showing latent Divisions.

No.	Observed Weight	Calculated Weight
141	297.8 mg.	297.8 mg.
		148.9 mg.
	92.8 mg.	74.4 mg.
		—24.7%
		37.2 mg.
	14.7 mg.	18.6 mg.
		+20.9%
		9.3 mg.
		4.6 mg.
		2.3 mg.
	1.2 mg.	1.2 mg.
	No. of divisions = 8	

No.	Observed Weight	Calculated Weight
97	370.1 mg.	370.1 mg.
		185.0 mg.
	106.3 mg.	92.5 mg.
		—14.9%
		46.2 mg.
	20.5 mg.	23.1 mg.
		+11.2%
		11.5 mg.
		5.7 mg.
	2.8 mg.	2.8 mg.
	No. of divisions = 7	

No.	Observed Weight	Calculated Weight
99	162.6 mg.	162.6 mg.
		81.3 mg.
	55.5 mg.	40.6 mg.
		—36.7%
		20.3 mg.
	13.7 mg.	10.1 mg.
		—35.6%
		5.0 mg.
	2.6 mg.	2.5 mg.
	No. of divisions = 6	

Table III contains the observed and calculated weights (tabulated to show latent divisions) of three individuals. Number 141 has eight calculated cell divisions, number 97 has seven, and number 99 has six. These larvae were selected because the weight of the newly hatched larva in each case corresponds to that calculated by the method of Bodenheimer. The table shows that, notwithstanding the variations which are permitted before any change in the number of cell divisions is apparent, some larvae are found whose weights show a very close agreement with those calculated when eight cell divisions are assumed, and others which fit the calculations when only six cell divisions are assumed. If the method of calculating latent divisions has any justification in fact, it must be concluded that the number of divisions in the Japanese beetle larva varies from six to eight.

This variation would further justify the conclusion that the average of the group cannot be used in the calculation of growth constants and that the principle of Przibram is not applicable to the Japanese beetle.

Bodenheimer (1932) lists the average growth factors for the various instars of a number of holometabolous insects. In most cases he obtained high growth factors indicating a number of latent divisions between molts. Usually there are wide deviations between the experimental and calculated results, as indicated below for *Dytiscus semisulcatus* (Bodenheimer 1932, page 566.)

Observed Weight mg.	Calculated Weight mg.	Percentage Deviation*
1300	1300	.....
....	650	.....
400	325	— 23.0
....	162	.....
100	81	— 23.4
30	40	+ 25.0

Bodenheimer (1932, page 555) states, "Als wichtigste Fehlerquellen sind anzusehen: 1. Die individuelle Variation, welche durch Wägen einer genügend grossen Individuenzahl behoben werden kann; 2. die Därmfüllung, welche direkt nach der Häutung ausgeschaltet ist; 3. ungleiche Temperatur-, Feuchtigkeits-, Nahrungs bzw. andere Umweltverhältnisse." It seems questionable whether averages of figures which vary as greatly as do the weights of different Japanese beetle larvae have any significance in the calculation of growth constants. If the number of cell divisions in an insect is to be calculated, readings made on the individual must be used and not averages of readings made on a number of individuals of a group, as is advocated by Bodenheimer.

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* The figures in this column were not given in Bodenheimer's paper but were calculated by the writer.

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An Answer to E. Graywood Smyth on "Synopsis of Cicindelidae" (Coleoptera).

By ALAN S. NICOLAY, Montclair, New Jersey.

(Continued from page 131.)

Mr. Smyth accuses us of being arbitrary in our reductions of names to synonymy without more fundamental reasons. He cites *mirabilis* as an example. If Mr. Smyth were only posted on the literature after 1907, he would have known that we had nothing whatsoever to do with it! Dr. Walther Horn in his last list (Trans. Am. Ent. Soc. LVI, 1930, page 80) did this and, after I carefully examined the single type specimen, I agreed, except that as we could find no reason for continuing the name *lauta*, both were placed as synonyms of *auduboni*, instead of *mirabilis* being a synonym of *lauta*, as recorded by Dr. Horn.

Shortly after completing our paper it was my privilege to examine the tiger beetle collection of Mr. William C. Wood of New York City. In it were several examples of *mirabilis*. Mr. Leng also called this variety to my attention. In view of the fact that this insect is, therefore, apparently not a unique sport, I feel it should be returned to the standing of a good geographical variety, distinguished by its bright cupreous head and

thorax. The elytra are of course green and in the type the margins are blue, but this probably does not run constant in a large series. *Mirabilis* should be placed after *audubont* in our key. It occurs in California (Dutch Flat, Placer County).

In the middle of the last paragraph (p. 202) of Mr. Smyth's paper he "suggests" the name *Cicindela plattensis*. Of course no type, specific locality or paragraphed description are necessary! This name is erected to take care of those forms of *denverensis* with complete markings such as differentiate *cyanocephala* and *splendida*. I had considered recognizing this form but decided to concur with Dr. Walther Horn, who, also after examining the Casey types, recognized only *denverensis*. For those who prefer a name for this more maculated variety, *conquisita* Casey has priority, with *orcada* Casey and *plattensis* Smyth as synonyms.

Although *purpurea* and *limbalis* do occur in approximately the same localities, in the East they are seldom found on the same spot or under similar conditions together. By this I mean that *purpurea* is very abundant in South Jersey and on Long Island, New York, in the pine barrens or near them; *limbalis* is never found there or even near there. *Limbalis* is taken on the tops and near the tops of hills overlooking the Hudson River around Bear Mountain, West Point, etc., New York, also on the higher hills surrounding Greenwood Lake in New Jersey and New York. *Purpurea* is taken in northern New Jersey also, but nearer Newark and at lower elevations. It approaches the land of *limbalis* at Midvale where it is found at lower elevations while *limbalis* commences to be found on the tops of the hills. An occasional *purpurea* is taken with these specimens of Midvale *limbalis*, although it is not established there in quantities as is *limbalis*. Also *purpurea* is found exclusively on the west shore of Greenwood Lake, high on the cliffs among the scrub pine and oak trees and running on the bare rocks, while *limbalis* is found on the east shore where the trees are deciduous. Last autumn in the Blue Ridge Mountains, (Skyland) Virginia, I found *purpurea* at lower elevations, while a single *limbalis* was taken near the top of Stony

Man Mountain. From these field observations I should say that *purpurea* and *limbalis* represent closely related but still abundantly distinct species.

Despite the last sentence in our introduction (p. 344) "The bibliography in this paper will also include the more important works on North American Cicindelidae," Mr. Smyth adds some additional papers stating they "will supply a few of the omissions from the bibliography of the authors."

In closing, I would like to quote from two letters received, acknowledging reprints of our paper. Dr. Walther Horn writes January 12, 1933—"I have seen with the greatest interest your synopsis on the Cicindelidae published together with Mr. H. B. Weiss. Please hand over also my best congratulations to the last one. I wish you could finish in near future this big work in the same way as you have begun. There is certainly a great need for such a Synopsis you are going to publish as the old ones are ancient and lists are not sufficient for the beginner."

Mr. Charles Leng writes January 4, 1933—"I have read with interest your remarks on the variations of *Cicindela purpurea* which in the main are well considered."

Finally I regret that such a long lapse of time has occurred between our first paper and the next. Unfortunately lack of time and a paper on Carabidae already started, has been the cause. I hope to have the next *Cicindela* paper in print during the current year.

Collecting Catocalae (Lepid.: Noctuidae).

By Auburn E. Brower, Bar Harbor, Maine.

Catocalas are found thruout the United States, a number of species being found in almost all localities. Three important methods are used in securing them: collecting the moths on tree trunks, rustic buildings, verandas, caves in the rock, cliffs, etc.; catching them at bait at night; and rearing. Deciduous trees are usually selected as resting places. Oak, hickory, elm,

poplar, walnut, willow, dogwood, maple, tulip, and hawthorn are preferred. Usually mature stands, rather free from underbrush, are chosen, but good catches are made in situations ranging from shade trees along city streets to dense forest growths. The groves upon knolls or ridges are often favored. On the live oaks and huge cypresses of the swamps they rest and also about the bases of the live oaks in the mountains of California. A leafy branch may be used to brush the trees. Suitable buildings, caves, and crevices in the rock are rich collecting places especially in the West. They are local in many sections and their favorite localities must be sought. Hilly regions are best. Weather conditions greatly influence the numbers which can be found from day to day. Some Catocalas are taken as early as late March in southern Florida and by early June in the central States.

A net must not be used to collect cabinet specimens, but may be used to collect females for eggs. Perfect specimens can be secured sometimes with a net when it is possible to clap the open net to the ground and hold the bag up and open until a bottle can be slipped in from below and over the moth. They should be collected by stealthily placing wide-mouthed cyanide jars over the resting insects on the tree trunks, etc. When approaching a moth studiously avoid snapping a twig or casting a shadow over it, and place the cyanide jar over it from below. After practice surprising numbers can be caught. The writer usually leans around the tree. Jar caps like those on mayonnaise jars are preferable. Sometimes a bottle with a leather funnel slashed around the margin is mounted on a pole and used to catch the moths. After the moth is caught turn the bottle if necessary to keep the fluttering insect off of its back until it becomes quiet. Then the moth should be pinned in a killing box or put in an envelope and returned to a cyanide jar. The author uses four large strong cyanide jars. Two are used alternately for catching the moths, and the other two for papered specimens. After leaving them in a cyanide jar for sixty minutes they should be packed in a stout box. The resting position of each species before it is disturbed should be

observed, and also other habits, and these recorded. At home they should be turned out of the envelopes and be spread, pinned, or put in regular papers, always with data. Specimens should be so placed in the envelopes that the antennae lie along the front margin of the wings. Triangular envelopes should be made of medium weight paper; rectangular ones of glassine are poor.

A bait line is the only successful way known of getting some desirable species, and it is often the best method of collecting. It may be inferior to daylight hunting especially for the common species. Both methods should be tried, but some of the small ones are successfully secured at bait only. Bait lines are best along roads or paths thru timber. Mature, living deciduous trees are best, and in open stands or groves. Shade trees and even fence posts have given big catches. A bait line increases in attractiveness and should be baited day after day. Sometimes changing a bait line to another locality brings success. Greatly different catches may be made on trees twenty feet apart. Bait should be applied between sundown and dark breast high on the lee side of the trees. Most baits are applied with a big brush. Many bait mixtures are improved by stirring in a teaspoonful of amyl acetate just before applying them; formerly Jamaica rum was used. Warm dry weather is usually best but not always. The two hours after dusk are usually best and so are warm dark nights. The time when the different species appear at bait should be recorded and also their actions at bait.

Many different materials and mixtures have proved to be attractive at some time in some place. Nearly all depend upon fermentation products from fruits or other sweet substances for their attractiveness. Stale beer with a sweet or decaying fruit was long the most popular attrahent, rum or ethyl alcohol being added just before using. The following formulas have all been recommended: a mixture of apple cider and New Orleans sugar; ordinary syrup diluted with fermented fruit juice and rum; molasses one pound, brown sugar two pounds, two bottles of stale beer (left in sun for two or three days), pineapple essence, and rotting bananas; stale beer,

rotting bananas, and honey water; molasses and stale beer boiled down; many combinations of rotting or fermenting fruit pulp, especially apples and peaches, combined with molasses (preferably Blackstrap) and sugar make excellent baits. These are best with active fermentation present. Bevo and raisins fermented are good. Bull's-eye lanterns, spot lights, and gasoline lanterns are used in collecting the moths at bait. Gasoline lanterns are favored; moths which take wing often flutter to the ground and may be caught. Moths drop downward as they take wing and so the cyanide jar should be brought up from below. Movements should be quiet, rapid, and precise.

Some Catocalas may appear at bait in the daytime, especially in high altitudes where they also feed on sap flows by day. Some have been reported at fruit. Sap flows on oak, hickory, willow, maple, etc., may be very attractive. Some desirable species are taken at flowers about dark. Purple milkweed, persimmon, phlox, mescal, yucca, catalpa, etc., are attractive to some species. These methods are unusual ones, and notes should be made in all cases regarding conditions, time of appearance, actions while feeding, and other habits.

In general Catocalas are not strongly attracted to light, but most species are taken at light and big catches have been made at light. Warm, cloudy nights with a drizzling rain are best. Gasoline lanterns are usually used. A white sheet should be stretched behind the light (an overhang at the top helps) and another spread on the ground. From eleven until three o'clock yields most Catocalas. The species and time of the night when they appear should be recorded.

The eggs of Catocalas are found upon trees during the winter. The grayish disk-shaped eggs of the hickory-feeders are found between the scales of hickory bark, in localities where the moths rested. The more or less hemispherical ribbed eggs of the other groups are found secreted on the bark of the oaks, willows, Populus, etc. Information is needed on where and how the eggs are placed.

The worn or imperfect females which are to be kept for eggs, may be placed in envelopes in the field. They should be

kept as cool as possible. Two quart jars, four quart paper bags, tin boxes, and wire cages have all been used successfully in securing eggs. A piece of scaly or flaky bark of the food plant or pleated cloth should be enclosed into which the female can tuck her eggs. Each female should be fed a small piece of overripe fruit or some semifluid sweet when confined and again later at intervals of a few days. Sometimes a little water is put in the jars and a damp cloth may be spread under the cover of the tin boxes. The caged insects should be kept in a cool place and where rodents cannot get to them. Well-ventilated screen wire cylinders or cages are apparently best for many of the western species. Only one female should be put in a cage and the dead moth should be saved with her eggs that the larvae may be positively identified and the offspring compared with the parent. The eggs should be kept in a cool place. Eggs may be shipped in a quill, or paper bags may be folded leaving the contents inside.

The protectively colored larvae rest upon or near the food plant by day, feeding mainly by night. Larvae of some groups, which feed on bushes, feed by day. Some crawl from their host plant to hide in leaves and debris, but most species secrete themselves in crevices or furrows in the bark or other hiding places. Banding trees with old tow or burlap sacks, old clothes, cement bags, etc., furnishes a hiding place where the larvae will be found. Such bands should be put on seventy days or more before the moths appear. The bands will then have time to weather, after which they should be examined every few days. Hickory, pecan, walnut, willow, poplar, cottonwood, oak, black locust (*Robinia*), crabapple, hawthorn (*Crataegus*), *Myrica, Amorpha,* and a few related species are their food plants. The larvae may be known by their protective color, rounded upper surface, and flat ventral surface, the latter with purplish black spots in the middle of each segment. They appear hairless, having only a few fine setae. The desirable bush-feeding larvae on *Crataegus* and other bushes can be secured by beating. Shingles leaned together at the base or crumpled old paper about the bases of trees are used to trap larvae.

The different habits of the larvae should be noted. When rearing, glass containers must be kept out of the sun, and cages must be kept very clean to check diseases. Injured or sickly larvae should be preserved in 70% alcohol. But few parasites are known from Catocala larvae, and all parasites should be saved with a full record. Partly rotten leaves should be provided for forming the cocoon in cages. The pupae are formed in a thin cocoon under loose bark, in crevices and cavities, and especially in leaves and debris on the ground. Much fuller records of the pupal habits are needed. The pupal period is usually twenty to thirty days.

On the Stabilizing of Four Generic Names (Lepid.: Rhopalocera).

To students of the involved generic nomenclature of the Palaearctic and Nearctic Diurnal Lepidoptera, the recent publication of the "Generic Names of British Rhopalocera" will prove of great interest. This pamphlet has been prepared by Mr. Francis Hemming at the request of the Committee on Generic Nomenclature of the Royal Entomological Society of London, and includes full details regarding type fixation and synonymy. Appended to the list is the first report of the Lepidoptera Sub-committee to the main committee, and following Mr. Hemming's suggestions, the suspension of the Law of Priority in four cases is advocated by this subcommittee, the grounds being that strict application of the rules would cause serious, and quite unnecessary, disturbance in existing practice.

The genera involved, with their proposed genotypes, are as follows:

Argynnis Fabr. (*P. paphia* Linn.); *Vanessa* Fabr. (*P. atalanta* Linn.);

Strymon Hbn. (*S. melinus* Hbn.); *Colias* Fabr. (*P. hyale* Linn.).

Welcoming any action that would assist in stabilizing generic Nomenclature, the undersigned lepidopterists express their full agreement with the recommendations of the above subcommittee and would urge the adoption of this report.

E. L. Bell, J. A. Comstock, C. H. Curran, W. T. M. Forbes, J. D. Gunder, E. I. Huntington, A. B. Klots, J. McDunnough, C. J. dos Passos, F. E. Watson, R. C. Williams, Jr.

Notes and Descriptions of West American Cerambycidae (Coleoptera).

By E. Gorton Linsley, Oakland, California.

Aplagiognathus remotus new species.

Elongate, reddish-brown, shining. Head piceous, densely and coarsely rugoso-punctate; mandibles stout, shorter than head, irregular in shape, sides subangulate, dorsal surface with a laterally compressed, longitudinal carina, punctation coarse; antennae attaining the basal third of elytra, scape stout, coarsely punctured, remaining segments slender. Prothorax transverse, twice as wide as long, sides subparallel, with a number of small, uneven, spine-like teeth along the margin; apex and base sinuate; surface not coarsely punctured, without any large irregularly sculptured areas. Elytra scarcely wider than the prothorax, twice as long as broad, widest just behind the middle; costae indistinctly evident; apices rotundate-truncate, without trace of sutural spine. Tarsi moderately dilated, first segment longer than second. Fifth ventral abdominal segment transverse, densely fringed at apex with yellow hairs. Length (exclusive of mandibles) 42.5 mm.; breadth 16 mm.

Holotype ♂, (No. 3822 Mus. Calif. Acad. Sci.) and one *paratype*, from Mt. Washington, near Nogales, Arizona, alt. 6000 feet, July 20, 1919, J. A. Kusche collector, in the collection of Dr. E. C. Van Dyke, to whom I am indebted for the privilege of studying this species.

This, the first recorded species of *Aplagiognathus* from within the borders of the United States, seems perfectly congeneric with the Mexican *A. spinosus* Newman and *A. hybostoma* Bates. From both of these, however, *A. remotus* may be distinguished by the short, closely-placed lateral spines of the prothorax and the absence of irregular pronotal sculpture.

Stenodontes (Mallodon) masticator Thomson.

This Mexican species occurs in Arizona both in the Chiricahua Mts. (Van Dyke collection) and Huachuca Mts. (J. O. Martin collection). The species resembles a small *S. dasytomus*, but differs in the tridentate genae and the finely punctured pronotum with reduced and completely separated glabrous areas.

STENODONTES (NOTHOPLEURUS) LOBIGENIS Bates.

Mr. R. E. Blackwelder has recently submitted to me a series of over fifty examples of *S. lobigenis* from Palm Springs, California. These specimens differ from typical Mexican and Lower Californian examples, only in the shorter mandibles of the male. The subgenus *Nothopleurus* is distinguished by the arcuate met-episterna, but this condition apparently exists only in the male. In the female the met-episterna is straight, although distinctly narrower than in either *Stenodontes* (s. str.) or *Mallodon*.

TETROPIUM AURIPILIS Bates.

I have before me a beautiful *Tetropium* from the Chiricahua Mts., Arizona, taken by Mr. J. A. Kusche on Fly's Peak, alt. 9000 feet, (Van Dyke collection). The specimen is shining black, with the antennae, legs, and prothorax densely pilose, and the elytra indistinctly costate and clothed with a short, dense, golden orange pubescence. Notwithstanding a difference of over 1200 miles in distribution and the fact that one individual was captured in a locality on the edge of the tropics, Las Vigas, Mexico, and the other in a desert mountain range, the Arizona example agrees so well with Bates'[1] very brief description of *T. auripilis*, that I hesitate to describe it as new.

Oeme californica new species.

Elongate, testaceous, clothed with a short, dense, yellowish pubescence. Head narrower than prothorax, densely, finely punctured; front short, vertex deeply, longitudinally sulcate; eyes coarsely granulated; antennae slender, uniformly testaceous, one-half longer than the body in the male, about as long as body in the female, segments three to five or six ciliated, tuberculate on inner side; scape moderately stout, very densely and coarsely punctured, second segment small, broader than long, third segment about twice as long as scape, fourth and following segments diminishing gradually in length toward apex. Prothorax transverse, strongly constricted over basal fourth, widest just behind the middle and gradually narrowed anteriorly; apex a little wider than base; punctation fine, dense, with a narrow longitudinal polished line in the male, and a

[1] Biol. Centr.-Amer. Col. V, 1885, p. 435.

broad median vitta in the female. Elytra nearly four times as long as broad, wider than the prothorax, feebly tricostate, the two inner costae most evident; apices narrowly rounded. Body beneath finely punctured, pubescent; abdomen brownish, last segment emarginate in the male, rounded in the female. Length 20-22 mm.; breadth 4-5 mm.

Holotype ♂, (No. 3823 Mus. Calif. Acad. Sci.), from Yosemite Valley, CALIFORNIA, June, 1908, E. M. Erhorn collector, *allotype* ♀, (No. 3824 Mus. Calif. Acad. Sci.) Pasadena, Calif., August, 1925, A. C. Davis collector, and one *paratype*, ♂, Lake Tahoe, Calif., July, 1931, L. W. Saylor collector, in the collection of the writer. Mr. Davis' example was reared from *Pinus*.

This species has stood in collections for many years under the name *O. costata* LeConte, a species to which it bears no great resemblance. *O. costata* is nigro-piceous, with the antennae very densely ciliated on all sides, and a less pronounced basal constriction of the prothorax. *O. californica* is more closely related to *O. rigida* Say, from which it may be distinguished by its large size (20-22 mm.), more evident elytral costae, and long antennae.

Oeme laticollis new species.

Elongate, parallel, piceous. Head very coarsely, closely punctate, sparsely clothed with pale recumbent pubescence; maxillary palpi with last two segments somewhat flattened; antennae longer than the body in the male, shorter than the body in the female, coarsely densely punctured, ciliated within and without; scape moderately stout, two and one-half times as long as broad, second segment about as long as broad, third segment about two times as long as first, fourth and remaining segments gradually diminishing in length toward apex. Prothorax distinctly transverse, one-fifth wider than long in the male, one-third wider in the female, broadest behind the middle, constricted at base, narrower at base than at apex; apical two-thirds rounded at the sides in the male, subparallel and gradually narrowed anteriorly in the female; punctation fine, deep, close, with a short, polished, longitudinal groove at base; sparsely clothed with a pale, recumbent pile, intermixed with scattered longer suberect hairs. Elytra tricostate, shining,

coarsely but irregularly punctured, clothed with suberect pale hairs; apices broadly rotundate-truncate. Legs indistinctly paler, coarsely punctured, clothed with pale hairs; first segment of the posterior tarsi longer than the second and third segments together. Body beneath paler, moderately densely, finely punctured, shining, clothed with pale suberect hairs; last ventral abdominal segment sub-truncate at apex in male, narrowly rounded at the apex in the female. Length 18-22 mm.; breadth 4-5 mm.

Holotype ♂, (No. 3825 Mus. Calif. Acad. Sci.), *allotype* ♀, (No. 3826 Mus. Calif. Acad. Sci.), and several paratypes, taken in Sequoia National Park, CALIFORNIA by Mr. F. T. Scott. *Paratypes* in the collection of Mr. Scott and the writer.

Oeme laticollis is closely related to *O. gracilis* LeConte. However, a series of the latter species from Poway, San Diego County (type locality) in the collection of Dr. F. E. Blaisdell, show the LeConte species to be smaller and narrower, with the prothorax about as broad as long, the elytral costae only faintly indicated, and the last two segments of the maxillary palpi cylindrical. The unique type of *Paranoplium densicolle* Casey [2] is a typical *Oeme gracilis* and probably came from San Diego.

Psyrassa brevicornis new species.

Elongate, black, shining, head and prothorax rufous. Head moderately closely, variolately punctured; eyes black, coarsely granulated; antennae slightly shorter than the body in the male, attaining the middle of the elytra in the female, flattened, clothed with recumbent pubescence, sparsely ciliate on inner side; first two segments piceous, remaining segments black; segments three to five spinose at apex, three to nine carinate; scape stout, coarsely punctured, second segment slightly longer than broad, third segment a little shorter than scape, outer segments subequal except eleventh which is longer and more slender than tenth. Prothorax a fifth longer than broad, sparsely, shallowly, but coarsely punctate; base constricted; sides ciliate with long erect pale hairs. Elytra wider at base than prothorax, more than three times as long as broad, coarsely, closely punctured, clothed with short suberect pale hairs; apices feebly

[2] Mem. Coleopt. XI, 1924, p. 250.

emarginate-truncate. Legs slender, black, more finely punctured, clothed with long pale hairs; femora at base reddish-piceous. Body beneath clothed with pale suberect hairs; pro-, meso-, and meta-sternum reddish; abdomen piceous, fifth ventral abdominal segment of female rounded at apex, of male truncate at apex. Length 11 mm; breadth 2.3 mm.

Holotype ♂, (No. 3827 Mus. Calif. Acad. Sci.), *allotype* ♀, (No. 3828 Mus. Calif. Acad. Sci.), and eleven *paratypes*, taken by the writer at Brownsville, TEXAS, between May 28 and June 6, 1932. Additional paratypes taken with the above, in the collection of Mr. J. O. Martin. The specimens were taken at light and collected on dead branches of *Acacia farnesiana* and *Pithecolobium flexicaulis*.

Closely related to *P. basicornis* Pascoe and *P. sallaci* Bates, but differing from these in having the antennal scape and legs piceous, antennal segments three to five spinose at apex and three to nine carinate, the prothorax less coarsely punctured and more densely pilose, and the elytral apices emarginate-truncate but not bidentate. From *P. sallaci* it further differs in its larger size, and in the shorter antennae which do not reach the apex of the body in either sex.

PHYMATODES BLANDUS LeConte subsp. **picipes** new subspecies.

This species occurs in northern California on various species of *Salix*. The typical form has the head, thorax, legs, and antennal scape rufous, the elytra metallic blue, and only the abdomen piceous. In the central Sierra Nevada Mountains, this form is replaced by a race in which the head, legs, and antennal scape are entirely piceous, as well as the apical and basal margins of the prothorax. This geographical race I propose to designate as *P. blandus* subsp. *picipes* new subspecies. *Holotype* (No. 3829 Mus. Calif. Acad. Sci.) and several *paratypes* collected by the writer in Yosemite Valley, CALIFORNIA, during May and June, 1930.

(To be continued)

Notes on some Tropical Florida Butterflies (Lepid.: Rhopalocera).

By Marston Bates, Museum of Comparative Zoology, Cambridge, Mass.

The butterfly fauna of tropical Florida is of considerable zoogeographical interest, as representatives of three regions—the Central American, the Nearctic and the Antillean—mingle there; yet this fauna is very inadequately known, and poorly represented in most collections. It is curious that of the many species common to Florida and Cuba, but with restricted range elsewhere, almost all were first described from Cuba, and in many instances our knowledge of the life history comes entirely from Cuban sources. Florida has had no Gundlach.

Many species that have been recorded from this region have not been found in recent years, and authentic Florida records of such species would be of great interest. *Papilio devilliersi, Metamorpha stelenes* and *Diacthria clymena* may be cited as examples. Florida labels on such species seem often to have been faked, and must be viewed with caution; one set of Chokoloskee labels found in some museums certainly belongs in this class, and there are many isolated instances.

The notes published here were made in connection with a study of the butterflies of Cuba, and a detailed account of the nomenclatorial system used will be found in a paper shortly to be published on that fauna. The Florida forms of *Ascia, Precis* and certain other genera are involved in general taxonomic tangles, and it seems impossible to clear up their nomenclature without complete revision of the groups to which they belong.

Papilio polydamas lucayus.
Rothschild and Jordan, 1906, Nov. Zool., XIII, p. 521.

Florida specimens of *polydamas* agree much more closely with those from the Bahamas than with those from Cuba or Central America. The outstanding difference is in the anal spot on the underside of the hindwing: in *lucayus* the yellow is much more extensive than in *polydamas,* always extending

across vein Cu_2, often reaching Cu_1; the yellow and red bars are usually contiguous in *lucayus*, separated in *polydamas*.

PAPILIO ARISTODEMUS PONCEANA.

Papilio ponceana Schaus, 1911, ENT. NEWS, XXII, p. 438; Holland, 1930, Ann. Carnegie Mus., XIX, p. 191; *id.*, 1931, Butterfly Book, p. 318, pl. 70, f. 10.

There is a female of this rare butterfly in the Museum of Comparative Zoology from Coconut Grove, Florida, May 31, 1924, G. B. Fairchild. The question of subspecific versus specific rank discussed by Holland (1930) is perhaps not worth much added discussion; Holland, however, seems always to have compared the form with the Hispaniolan *aristodemus*, while it is really much more like the Cuban *temenes*, from which it differs principally in the narrower median yellow band of the upper side. *Ponceana* will probably eventually be found on some of the islands of the Bahamas.

APPIAS ILAIRE POEYI.

Pieris ilaire Poey, 1832, Cent., no. 12, 3 figs.
Appias poeyi Butler, 1872, Proc. Zool. Soc. London, p. 49.
Tachyris ilaire, var. *neumoegenii* Skinner, 1894, ENT. NEWS, V, p. 110.
Melete ilaire Holland, 1930, Ann. Carn. Mus., XIX, p. 198.
Melete ilaire form *neumoegeni* Holland, 1931, Butt. Book, p. 277, pl. 35, f. 5.

The series of this butterfly in the Museum of Comparative Zoology from Florida, the Bahamas, Cuba and Hispaniola seem quite uniform, and offer no justification for the separation of races, although specimens from Texas and Central America, and from Jamaica, belong to distinct subspecies. The male figured by Holland (1931) is not from Florida: in *poeyi* males the black of the wing apex above is reduced to a very fine line, and the base of the costal margin is powdered with black.

The generic position of this species has recently been discussed by Klots (1933, Ent. Am., XII, p. 208). The larva of *Appias ilaire* differs from that of *Melete salacia* in several very important respects, and the resemblance between the adults is largely superficial.

EUREMA MESSALINA BLAKEI.

Terias blakei Maynard, 1891, Man. N. Am. Butt., p. 216.

This is the Bahaman race of *messalina*, which may be distinguished by the reduced black markings of the female above. I have seen no Florida specimens except the type labelled "Sanford, Fla."

DANAIDA ERESIMUS.

Papilio eresimus Cramer, 1777, Pap. Ex., II, p. 121, pl. 175, f. G, H.

A female of this species was collected by Mr. F. E. Church on Lower Metacumbe Key, Feb. 28, 1932. It is now in the American Museum of Natural History, and I am indebted to Mr. F. E. Watson for the privilege of studying and reporting on it. To the best of my knowledge, this species has not previously been reported from our fauna, and it has only recently been found on the Greater Antilles. It is now known from Cuba, Jamaica, Hispaniola and Martinique; but although Hispaniola specimens were described by Hall (1925, Entom., XVIII, p. 165) as *Danais kaempfferi*, I can find no constant grounds for subspecific separation. There seem to be two color forms—a light and a dark—on all of these islands, the Florida specimen belonging to the lighter form. The male genitalia of specimens from Panama, Jamaica, Hispaniola and Cuba do not seem to differ materially, although specific differences in the genitalia are well marked in this genus.

D. eresimus has probably been overlooked in our fauna previously chiefly because of its resemblance to *berenice* on the wing. I captured it in Cuba by taking as many specimens of *berenice* as possible, and examining them carefully before freeing them.

COLAENIS JULIA NUDEOLA.

Colaenis julia cillene Stichel, 1907, Gen. Ins., p. 12, pl. 2, f.1.
C. julia cillene form *nudeola* Stichel, *l. c.*, p. 12.
Colaenis julia carteri Riley, 1926, Entom., LIX, p. 240, pl. II, f. 1.

Two subspecies of this butterfly occur in the United States, one in Texas, and the other in Florida. The Florida form is

similar to that found in Cuba, for which *nudeola* seems to be the oldest name, although first applied to an aberration. Cramer's name *cillene* cannot apply, as he states definitely that his specimen came from Surinam, and his figure can be matched with specimens from northern South America much more easily than with Cuban ones; furthermore, Cramer is not known to have had any Cuban specimens at all. The status of the Bahaman race described by Riley seems to me uncertain. The range of variation in the Bahamas is certainly a little different from that in Cuba, but the overlapping is large. Florida males above have the appearance of typical Cuban specimens, below they show the purplish cast found on some Bahaman specimens; if this coloring be taken as the criterion of *carteri*, Florida specimens should bear that name. Our specimens from Andros Island, however, do not show this purple, although the markings above agree well with those of New Providence specimens. The other West Indian races of *julia* are much more constant and distinct, and it seems to me best, for the present at least, to consider all specimens from Cuba, the Bahamas and Florida as forming the race *nudeola*.

This butterfly is quite common on the Florida Keys, and is quite often taken on the mainland as far north as Miami.

Pogonomyrmex occidentalis Cresson at Taos, New Mexico. (Hym.: Formicidae.)

The writer chanced upon an area near Taos, New Mexico, where hundreds of pebble mounds of the Western Harvesting Ant, *Pogonomyrmex occidentalis* Cresson, were closely aggregated. The unusualness of the situation lies in the fact that the elevation was somewhat over 8,500 feet. These ants are seldom found in any numbers above a 4,000-foot elevation and are extremely rare above 5,000 feet. An attempt to secure a photograph of the mounds failed because of the dark rainy day. The writer was unable to locate additional grouped or scattered mounds of this harvesting ant in any part of the area. The concentration might be explained by a knowledge of the soil texture, temperature and moisture, and the predominating vegetation.

A. C. Cole, Jr., Twin Falls, Idaho.

List of the Titles of Periodicals and Serials Referred to by Numbers in Entomological Literature in Entomological News.

1. Transactions of The American Entomological Society. Philadelphia.
2. Entomologische Blätter, red. v. H. Eckstein etc. Berlin.
3. Annals of the Carnegie Museum. Pittsburgh, Pa.
4. Canadian Entomologist. London, Canada.
5. Pysche, A Journal of Entomology. Boston, Mass.
6. Journal of the New York Entomological Society. New York.
7. Annals of the Entomological Society of America. Columbus, Ohio.
8. Entomologists' Monthly Magazine. London.
9. The Entomologist. London.
10. Proceedings of the Ent. Soc. of Washington. Washington, D. C.
11. Deutsche entomologische Zeitschrift. Berlin.
12. Journal of Economic Entomology, Geneva, N. Y.
13. Journal of Entomology and Zoology. Claremont, Cal.
14. Entomologische Zeitschrift. Frankfurt a. M., Germany.
15. Natural History, American Museum of Natural History. New York.
16. American Journal of Science. New Haven, Conn.
17. Entomologische Rundschau. Stuttgart, Germany.
18. Internationale entomologische Zeitschrift. Guben, Germany.
19. Bulletin of the Brooklyn Entomological Society. Brooklyn, N. Y.
20. Societas entomologica. Stuttgart, Germany.
21. The Entomologists' Record and Journal of Variation. London.
22. Bulletin of Entomological Research. London.
23. Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricultura in Portici. Italy.
24. Annales de la société entomologique de France. Paris.
25. Bulletin de la société entomologique de France. Paris.
26. Entomologischer Anzeiger, hersg. Adolf Hoffmann. Wien, Austria.
27. Bolletino della Società Entomologica. Genova, Italy.
28. Ent. Tidskrift utgifen af Ent. Föreningen i Stockholm. Sweden.
29. Annual Report of the Ent. Society of Ontario. Toronto, Canada.
30. The Maine Naturalist. Thornaston, Maine.
31. Nature. London.
32. Boletim do Museu Nacional do Rio de Janiero. Brazil.
33. Bull. et Annales de la Société entomologique de Belgique. Bruxelles.
34. Zoologischer Anzeiger, hrsg. v. E. Korschelt. Leipzig.
35. The Annals of Applied Biology. Cambridge, England.
36. Transactions of the Entomological Society of London. England.
37. Proceedings of the Hawaiian Entomological Society. Honolulu.
38. Bull. of the Southern California Academy of Sciences. Los Angeles.
39. The Florida Entomologist. Gainesville, Fla.
40. American Museum Novitates. New York.
41. Mitteilungen der schweiz. ent. Gesellschaft. Schaffhausen, Switzerland.
42. The Journal of Experimental Zoology. Philadelphia.
43. Ohio Journal of Sciences. Columbus, Ohio.
44. Revista chileña de historia natural. Valparaiso, Chile.
45. Zeitschrift für wissenschaftliche Insektenbiologie. Berlin.
46. Zeitschrift für Morphologie und Ökologie der Tiere. Berlin.
47. Journal of Agricultural Research. Washington, D. C.
48. Wiener entomologische Zeitung. Wien, Austria.
49. Entomologische Mitteilungen. Berlin.
50. Proceedings of the U. S. National Museum. Washington, D. C.
51. Notulae entomologicae, ed. Soc. ent. Helsingfors. Helsingfors, Finland.
52. Archiv für Naturgeschichte, hrsg. v. E. Strand. Berlin.

53. Quarterly Journal of Microscopical Science. London.
54. Annales de Parasitologie Humaine et Compareé. Paris.
55. Pan-Pacific Entomologist. San Francisco, Cal.
56. "Konowia". Zeit. für systematische Insektenkunde. Wien, Austria.
57. La Feuille des Naturalistes. Paris.
58. Entomologische Berichten. Nederlandsche ent. Ver. Amsterdam.
59. Encyclopédie entomologique, ed. P. Lechevalier. Paris.
60. Stettiner entomologische Zeitung. Stettin, Germany.
61. Proceedings of the California Academy of Sciences. San Francisco.
62. Bulletin of the American Museum of Natural History. New York.
63. Deutsche entomologische Zeitschrift "Iris". Berlin.
64. Zeitschrift des österr. entomologen-Vereines. Wien.
65. Zeitschrift für angewandte Entomologie, hrsg. K. Escherich. Berlin.
66. Report of the Proceedings of the Entomological Meeting. Pusa, India.
67. University of California Publications, Entomology. Berkeley, Cal.
68. Science. New York.
69. Comptes rendus hebdoma. des séances de l'Académie des sciences. Paris.
70. Entomologica Americana, Brooklyn Entomological Society. Brooklyn.
71. Novitates Zoologicae. Tring, England.
72. Revue russe d'Entomologie. Leningrad, USSR.
73. Quarterly Review of Biology. Baltimore, Maryland.
74. Sbornik entomolog. národniho musea v Praze. Prague, Czechoslavokia.
75. Annals and Magazine of Natural History. London.
76. The Scientific Monthly. New York.
77. Comptes rendus heb. des séances et mémo. de la soc. de biologie. Paris.
78. Bulletin Biologique de la France et de la Belgique. Paris.
79. Koleopterologische Rundschau. Wien.
80. Lepidopterologische Rundschau, hrsg. Adolf Hoffmann. Wien.
81. Folia myrmecol. et termitol. hrsg. Anton Krausse. Bernau bei Berlin.
82. Bulletin, Division of the Natural History Survey. Urbana, Illinois.
83. Arkiv för zoologie, K. Svenska Vetenskapsakademien i. Stockholm.
84. Ecology. Brooklyn.
85. Genetics. Princeton, New Jersey.
86. Zoologica, New York Zoological Society. New York.
87. Archiv für Entwicklungs mechanik der Organ., hrsg. v. Roux. Leipzig.
88. Die Naturwissenschaften, hrsg. A. Berliner. Berlin.
89. Zoologische Jahrbücher, hrsg. v. Spengel. Jena, Germany.
90. The American Naturalist. Garrison-on-Hudson, New York.
91. Journal of the Washington Academy of Sciences. Washington, D. C.
92. Biological Bulletin. Wood's Hole, Massachusetts.
93. Proceedings of the Zoological Society of London. England.
94. Zeitschrift für wissenschaftliche Zoologie. Leipzig.
95. Proceedings of the Biological Soc. of Washington, Washington, D. C.
96. La Cellule. Lierre, Belgium.
97. Biologisches Zentralblatt. Leipzig.
98. Le Naturaliste Canadien. Cap Rouge, Chicoutimi, Quebec.
99. Mélanges exotico-entomologiques, Par Maurice Pic. Moulins, France.
100. Bulletin Intern., Académie Polonaise des Sci. et des Lett. Cracovie, Poland.
101. Tijdschrift voor entomologie, Nederlandsche Entomol. Ver., Amsterdam.
102. Entomologiske Meddelelser, Entomologisk Forening, Copenhagen.
103. Journal of the Kansas Entomological Society. Lawrence, Kansas.
104. Revista de la Sociedad entomologica Argentina, Buenos Aires.
105. Revista Entomologia, São Paulo, Brazil.
106. Anales Sociedad Cientifica Argentina, Buenos Aires.
107. Stylops: a Journal of Taxonomic Entomology, London.
108. Revista, Col. Nac. Vicente Rocafuerte, Guavaquil.
109. Arbeiten uber morphologische und taxonomische entomologie aus Berlin-Dahlem.

An Extraordinary Mound of the Occident Ant, Pogonomyrmex occidentalis Cresson. (Hym.: Formicidae.)

Near Seligman, Arizona, the writer chanced upon an unusually large mound of the western harvester ant, *Pogonomyrmex occidentalis* Cresson. The pebble mound was approximately three feet in height, sixteen feet in diameter and thirty-six feet in circumference. Thus the mound area was about two hundred and one square feet. Eleven entrances perforated the mound at widespread points. The nest must have housed hundreds of thousands of workers, for the cleared area surrounding the mound was literally alive with ants. This was the largest nest of this species the writer has ever observed. Large quantities of seed were stored in the nest chambers and most of the ants were carrying seeds into the nests.

A. C. Cole, Jr., Twin Falls, Idaho.

Entomological Literature

COMPILED BY LAURA S. MACKEY UNDER THE SUPERVISION OF E. T. CRESSON, JR.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

The **figures within brackets** [ ] refer to the journal in which the paper appeared, as numbered in the list of Periodicals and Serials published in our January and June issues. This list may be secured from the publisher of Entomological News for 10c. The number of, or annual **volume,** and in some cases the part, heft, &c. the latter **within** ( ) follows; then the pagination follows the **colon** :

All continued papers, with few exceptions, are recorded only at their first installments.

(*) Papers containing new forms or names not so stated in titles, have an * within parentheses thus (*) following the pagination of reference to paper.

(S) Papers pertaining exclusively to neotropical species, and not so indicated in the title, have the symbol (S) at the end of the title of the paper.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

Note. Titles of papers containing new forms or new names will be indicated by an asterisk within parentheses at end of reference, (*).

Papers published in the Entomological News are not listed.

GENERAL. — Carpenter, F. M. — Carboniferous insects from Pennsylvania in the Carnegie Museum and the Museum of Comparative Zoology. [3] 22: 323-341, ill. (*). **deLeon, D.**—An annotated list of the parasites, predators and other associated fauna of the mountain pine beetle in western white pine and lodgepole pine. [4] 66: 51-61. **Es-**

sig, E. O.—The historical background of entomology in relation to the early development of Agriculture in California. [55] 10: 1-11. **Grundel, J. G.**—Obituary. By E. C. Van Dyke. [55] 10: 48, ill. **Hering, M.**—Elevage et preparation d'insectes-mineurs. [L'Amateur de Pap.] 6: 301-309. **Leonard, M. B.**—Notes on insect conditions in Puerto Rico for the fiscal year, July, 1931, through June, 1932. [Jour. Dept. Agric. Puerto Rico] 17: 97-137. **McAtee, W. L.**—Protective resemblance in insects—Experiment and theory. [68] 79: 361-363. **Poulton, E. B.**—Entomology and human life. [Pro. R. Ent. Soc. London] 8: 165-170. **Schenkling und Horn.** Bitte des Deutschen Entomologischen Institutes um mitarbeit an der herstellung einer bibliographischen kartothek über die gesamte entomologische literatur der welt ab 1864. [109] 1: 83-84. **Schmith, K.**—Pro mimikry! [Ent. Jahr.] 1934: 198-200. **Schwartz, M.**—Dahlemer Arbeitsgemeinschaft. [109] 1: 1-6. **Wright, Grundell, Kusche.**—Necrology. By E. P. Van Duzee. [55] 10: 26.

ANATOMY, PHYSIOLOGY, ETC.—Abbott, C. E.—How Megarhyssa deposits her eggs. [6] 42: 127-133, ill. **Anon.**—Central nervous system of Araneida. [13] 26: 7-12, ill. **Basinger, A. J.**—Reproduction in mealybugs. [7] 27: 17-20. **Bates, M.**—The peristigmal gland cells of trypetid larvae. [7] 27: 1-4, ill. **Bostian, C. H.**—Biparental males and biparental ratios in Habrobracon. [92] 66: 166-181. **Brittain & Newton.**—Further observations on the pollen constancy of bees. [Can. Jour. Res.] 10: 255-263, ill. **Brumpt, E.**—Le gynandromorphisme chez les Ixodines. Un curieux cas obtenu dans un elevage d'Amblyomma dissimile. [54] 12: 98-120, ill. **Collenette, C. L.**—On the sexes of some South American moths attracted to light, human perspiration and damp sand. [9] 67: 81-84. **Drilhon, A.**—Sur le milieu inferieur des lepidopteres. [C. R. Soc. Biol.] 115: 1194-1195. **Eastman, L. E. S.**—Metachronal rhythms and gill movements of the nymph of Caenis horaria in relation to water flow (Ephemeroptera). [Pro. R. Soc. Lond.] Biol. Ser. 115: 30-48, ill. **Fulton & Chamberlin.**—An improved technique for the artificial feeding of the beet leaf hopper, with notes on its ability to synthesize glycerides. [68] 79: 346-348, ill. **Grandjean, F.**—Les organes respiratoires secondaires des Oribates. [24] 103: 109-146, ill. **Nicholson, A. J.**—The influence of temperature on the activity of sheep-blowflies. [22] 25: 85-99. **Ochmann, A.**—Falters

kämmchen und haarbürste. [18] 28: 13-18, ill. **Santschi, F.**—Sur l'origine de la nervure cubitale chez les Formicides. [41] 15: 557-566, ill. **de Vries, A. H.**—A cheap and effective blowfly trap. [Dept. Agric. Union So. Africa] Reprint 50: 3 pp., ill. **Whiting, Greb, Speicher.**—A new type of sex-intergrade. [92] 66: 152-165, ill. **Whiting, P. W.**—Egg-trinuclearity in Habrobracon. [92] 66: 145-151, ill. **Wigglesworth, V. B.**—The mechanism of stretching in the cuticle of Rhodnius prolixus. [Pro. R. Ent. Soc. London] 8: 141. **Wilson, S. J.**—The anatomy of Chrysochus auratus, Coleoptera: (Chrysomelidae) with an extended discussion of the wing venation. [6] 42: 65-84, ill. **Zacwilichowski, J.**—Ueber die innervierung und die sinnesorgane der flugel der honigbiene (Apis mellifica). Ueber die innervierung und die Sinnesorgane der flugel von köcherfliegen (Trichoptera). [Bull. Ac. Polonaise Sci.] B, 1933: 275-289; 305-319, ill.

ARACHNIDA AND MYRIOPODA.—Chamberlin & Ivie—A new genus of theridiid spiders in which the male develops only one palpus. [Bull. Univ. Utah] Biol. Ser., 2, No. 4: 18 pp. (S). **Chickering, A. M.**—Araneae from the Northern peninsula of Michigan. [Pap. Mich. Ac. Sci.] 19: 577-580. **Ebeling, W.**—A new predacious mite from southern California. (Erythraeidae.) [55] 10: 33-34, ill. **Gertsch, W. J.**—Some American spiders of the family Hahniidae. [40] 712: 32 pp., ill.* **Jacot, A. P.**—The Galumnas of the northeastern United States. [6] 42: 87-124, ill.

THE SMALLER ORDERS OF INSECTS.—Cowley, J.—Notes on Odonata (Corduliidae) of the neotropical region. [107] 3: 91-95, ill.*

ORTHOPTERA.—Rehn & Rehn—The Eumastacinae of southern Mexico and Central America. [Mem. Am. Ent. Soc.] No. 8: 84 pp., ill.*

HEMIPTERA.—Beamer, R. H.—A new genus and two new species of leafhoppers from California (Cicadellidae). [55] 10: 43-44. **Davis, W. T.**—New Cicadas from North America. [6] 42: 37-62, ill. **Essig, E. O.**—Note on the alder scale. [55] 10: 44. **Gould, G. H.**—A new genus of Veliidae. [103] 7: 56-61, ill. **Harris & Andre.**—Notes on the biology of Acantholoma denticulata. (Scutelleridae.) [7] 27: 5-15, ill. **Maxson, A. C.**—Four new pemphigids from Colorado (Aphidae). [7] 27: 34-42, ill. **Parish, H. E.**—Biology of

Euschistus variolarius (Pentatomidae). [7] *27*: 50-54. **Van Duzee, E. P.**—A new Brochymena. [55] 10: 22.

LEPIDOPTERA.—Benjamin, F. H.—Notes on the genus Rothschildia in the United States. (Saturniidae.) [55] 10: 12-16.* **Forbes, W. T. M.**—A grouping of the Agrotine genera. Supplement on some S. Am. types, including new names. [70] 14: 38 pp., ill. **Hoffmann, F.**—Beiträge zur naturgeschichte brasilianischer schmetterlinge. [Ent. Jahr.] 1934: 102-106. **Le Cerf, F.**—Deux Saturnoides nouveaux du Museum de Geneve. [Rev. Suisse Zool.] 41: 263-266, ill. (S*). **Lindinger, L.** —Das verhältnis der motte pronuba zu den Yucca-arten. [Ent. Jahr.] 1934: 85-93. **Romieux, M. J.**—Notes biologiques sur une Lycénide et une Hespéride du Brésil. [41] 15: 505-526, ill.

DIPTERA—Alexander, C. P.—New or little-known Tipulidae from Chiriqui, Panama. [7]: 55-73. **Bromley, S. W.**—The robber flies of Texas (Asilidae) [7] *27*: 74-113, ill. (*). **Huckett, H. C.**—A revision of the North American species belonging to the genus Coenosia and related genera. Part 1. The subgenera Neodexiopsis, Coenosia, Hoplogaster and related genera Allognota, Bithoracochaeta and Schoenomyza. [1] 60: 57-119, ill. (*). **Kuster, K. C.**—A study of the general biology, morphology of the respiratory system of certain aquatic Stratiomyia and Odontomyia larvae. [Pap. Mich. Ac. Sci.] 19: 605-658, ill. **Malloch, J. R.**—A new species of the genus Xanthaciura (Trypetidae). [107] 3: 78-79, ill. (S). **Painter, R. H.**—Two new species of North America Exoprosopa (Bombyliidae.) [103] 7: 68-70. **Paramonow, S. J.**—Ueber einige exotische (hauptsächlich sudamerikanische) Bombyliiden. [56] 13: 22-34. (*). **Smart, J.**—Notes on the biology of Simulium pictipes. [4] 66: 62-66, ill. **Smith, H. M.**—Notes on some bat-flies of southern Kansas and northern Oklahoma. [103] 7: 62-64. **Tomaszewski, W.**—Zur taxonomie der kohlfliegen Chortophila brassicae und Ch. floralis. [109] 1: 60-66, ill.

COLEOPTERA.—Brown, W. J.—The American species of Dalopius (Elateridae). [4] 66: 66-72. (*). **Chamberlin, W. J.**—New species of the genus Chrysobothris, with a key to the species of Horn's group IV. (Buprestidae). [55] 10: 35-42, ill. **Fall, H. C.**—On certain North American Elateridae, new and old. [6] 42: 7-36. **Hayes & Kearns**—The Pretarsus (Articularis) in Coleoptera. [7] *27*: 21-33, ill. **Hinton, H. E.**—Helichus puncticollis in Arizona (Dryopidae). [4] 66: 72. **Hinton, H. E.**—A new species of West

Indian Tytthonyx (Cantharidae). [55] 10: 30-32. **Hinton, H. E.**—Two genera of Aphodiinae new to Mexico. (Scarabaeidae.) [55] 10: 27-30, ill. (*). **Horn, W.**—Revision der gattung Pogonostoma (Cicind.) [109] 1: 7-34, ill. **Korschefsky, R.**—Weitere bemerkungen über Crotch' sche typen und beschreibung einer neuen Oryssomusart aus dem Deutschen Entomologischen Institut. [109] 1: 35-36. (S*). **Leng & Mutchler**—Saprinus dimidiatipennis. [6] 42: 86. **Linsley, E. G.**—A short review of the genus Atimia with the descriptions of two new species. [55] 10: 23-26. **Méquignon, A.**—Sur les Chelonarium des Antilles avec description d'espees nouvelles (Byrrhidae). [25] 39: 54-55. (S*). **Nunenmacher, F. W.**—Studies amongst the Coccinellidae, No. 6—New species. [55] 10: 17-21. **Pic, M.**—Neue exotische Coleopteren (Malacodermata) [26] 14: 45-47, cont. (S*). **Sabrosky, C. W.**—Notes on the larva and larval habit of Isohydnocera curtipennis (Cleridae). [103] 7: 65-68. **Schürhoff, P. N.**—Beiträge zur kenntnis der Cetoniden III. [Ent. Nachrich.] 7: 89-96, ill. (S*). **Tanner, V. M.**—Coleoptera of Zion National Park. No. II. [7] 27: 43-49.* **Twinn, C. R.**—The dermestid, Trogoderma versicolor a new pest of dried milk products. [4] 66: 49-51.

HYMENOPTERA.—Lindquist, A. W.—Notes on two Vespula nests from Kansas. [103] 7: 51-55, ill.

SPECIAL NOTICES.—Arbeiten ueber morphologische und taxonomische Entomologie aus Berlin-Dahlem. Arbeiten ueber physiologische und angewandte Entomologie aus Berlin-Dahlem. These two new serials are published by the Deutschen Entomologischen Institut der Kaiser Wilhelm-Gesellschaft, Berlin-Dahlem. Band 1, Nr. 1, of both have just been issued March 5, 1934. **Melanges entomologiques.** Memoire 5. Par Henri Gadeau de Kerville. Containing six papers reprinted from the Bulletin de la Societe des Amis des Sciences naturelles de Rouen, Annees 1930 et 1931, p. 269-492, ill.

Pyrameis cardui on New Year's Day. (Lepid.: Nymphalidae.)

On the first of January, 1934, in Boulder, Colorado, my wife and I saw an unusually small specimen of *Pyrameis cardui*. It lit on the sidewalk in front of us, and flew over into an adjacent garden.—T. D. A. Cockerell.

EXCHANGES

This column is intended only for wants and exchanges, not for advertisements of goods for sale or services rendered. Notices not exceeding three lines free to subscribers.

These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and, only when necessary those at the top (being longest in) are discontinued.

Wanted—Names and addresses of those desiring Coleoptera, Lepidoptera and Hymenoptera of Pennsylvania and New Jersey. R. C. Casselberry, 71 E. Price Ave., Lansdowne, Pa.

Exchange—Texas Orthoptera. F. B. Isely, Trinity University, Waxahachie, Texas.

Wanted—Names and addresses of those desiring insects from Colorado. Charles H. Hicks, P. O. Box 262, Boulder, Colorado.

Desire to Exchange—Lepidoptera—pupae—ova. Cocoons, chrysalids especially wanted. Correspondence desired from all parts U. S., Canada, Mexico, Central, South America. Arthur Smith, Los Banos, California.

Geometers Wanted for cash, or in exchange for West Coast Butterflies, Noctuids or other Geometers. Edward Guedet, P. O. Box 305, Napa, Calif.

Wanted—Papilios, Ornithoptera, Uranias, Morphos, Theclas, uniques, and many other attractive butterflies. Also living cocoons and pupae. A. Glanz, 740 New Lots Ave., Brooklyn, N. Y.

Exchange—Pachysphinx modesta. Progeny of modesta imperator (female) and normal male to exchange for Erinnys or other southern Sphingids. Heodes dorcas and others offered for Florida Theclas or Hesperiidae. Perfect specimens only. H. M. Bower, 1302 Davis Street, Evanston, Illinois.

Exchange—Will collect insects of Connecticut this season and desire to get in touch with collectors desiring this material, either in exchange or for cash. Harry L. Johnson, So. Meriden, Conn.

Wanted—Names and addresses of those desiring Cocoons of Actias luna and Automeris io. Exchange considered. Eggs in season. Virginia Weaver, 822 S. College Ave., Tulsa, Okla.

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HEMIPTERA

982.—**Blatchley** (W. S.).—Notes on a collection of Heteroptera taken in winter in the vicinity of Los Angeles, California. (Trans., **60**, 1-16, 1934) ..... .30

HYMENOPTERA

979.—**Mitchell** (T. B.).—A revision of the genus Megachile in the Nearctic Region. Part I. (Trans., **59**, 295-361, 2 pls., 1934) 1.30

LEPIDOPTERA

983.—**Williams & Bell.**—Studies in the American Hesperioidea. Part II. (Trans., **60**, 17-30, ill., 1934) ..... .30

977.—**Braun** (A. F.).—Pupal tracheation and imaginal venation in Microlepidoptera. (Trans., **59**, 229-268, 7 pls., 1933) 1.00

ODONATA

981.—**Calvert** (P. P.).—Two Mexican species of Palaemnema. (Trans., **59**, 377-381, 1934) ..... .20

ORTHOPTERA.

980.—**Hebard** (M.).—Studies in Orthoptera which occur in North America, north of the Mexican boundary. Parts 1 & 2. (Trans., **59**, 363-375, 1 pl., 1934) ..... .30

THYSANOPTERA

978.—**Steinweden** (J. B.).—Key to all known species of the genus Taeniothrips (Thripidae). (Trans., **59**, 269-293, 1 pl., 1933) ..... .50

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